Syllabus: MECH 417/517 Finite Element Analysis, Spring 2021 (via Zoom)

General Information (as of 1/24/2021)

Class hours: Tuesday & Thursday, 1:00 - 2:15 PM, via Zoom
Office hours: pending Zoom session
web-site: http://www.clear.rice.edu/mech517 (moving to Canvas)

Instructor

Prof. Ed Akin
Office: Mechanical Engineering Building, Room 221
Office: (713) 348-4879, Mobile: 713-857-9625
Email: akin@rice.edu

Course Description

This is an elective course. The course provides a general introduction to the theory behind the classic parametric finite element (FE) analysis as a common numerical analysis tool. It covers the fundamental theoretical approach beginning with a review of differential equations, boundary conditions, integral forms, interpolation, parametric geometry, numerical integration, and matrix algebra. Next, engineering applications to field analysis, stress analysis and vibrations are introduced. Time dependent problems are also treated. The implementation of FE analysis is taught through the modification of a library of example Matlab scripts. Students are also introduced, by means of selected tutorials, to the commercial finite element system SolidWorks which is similar to one they could be expected to use upon graduation.

Course Goals

Upon completion of the course students should be able to: 1. To correlate a differential equation and its equivalent integral form 2. Understand parametric interpolation and parametric geometry 3. Utilize numerical integration in 1-, 2-, and 3-dimensions 4. Assemble (scatter) finite element matrices to the system matrices 5. Enforce essential boundary conditions to a matrix system 6. Recover system reactions 7. Post process a solution to find its gradient and its integral 8. Apply commercial software to stress analysis, thermal analysis, and vibrations

Prerequisites

Basic physics (PHYS 101), basic calculus MATH 101, or equivalents.

Recommended Notes

J.E. Akin, *Parametric Finite Element Analysis*, located on Rice Canvas pages

Reference Books

T.J.R. Hughes, *The Finite Element Method,* Dover, 2000, McGraw-Hill, 1995.
J.E. Akin, *Finite Element Analysis Concepts via SolidWorks,* World Scientific, 2010, Draft copy on Canvas

Notation
See Canvas file Notation.pdf

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Grading (Graduate students will be assigned extra homework and tutorials.)

Homework	60%	
Tutorials	20%	(From SolidWorks Simulation Tutorials)
Test #1	10%	(take-home, open resource, time limited)
Test #2	10%	(take-home, open resource, time limited)

Homework Policy

Homework will be assigned on the last class of the week (usually Thursday). It will be due, as PDF email to the instructor (due to past problems with Canvas), by midnight Friday of the following week.

Homework is meant as a learning exercise and you are encouraged to consult anyone (students, teaching assistants, me) and anything (notes, books, your own experiments) if it helps you to understand the material. However, you may not consult another person's solution to any given problem or solutions from past years.

Exam Policy

The open reference midterm exam (with a cover sheet) will be assigned on a Thursday and will be due at midnight a week later. The time limit is two hours, excluding a ten minute break without access to reference materials.

The final exam will be distributed (with a cover sheet) on the last day of classes and is due at midnight on the last day of finals period. Tests are taken under the Rice Honor Code system.

Students with disabilities

Any student with a disability requiring accommodations in this course is encouraged to contact me after class or during office hours. Additionally, students should contact Disabled Student Services at the Ley Student Center.